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COMPLETE SPECIFICATION

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ORIGINAL

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Invention Title:	**POWER AND DATA COMMUNICATIONS TRANSMISSION SYSTEM**

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The following statement is a full description of this invention, including the best method of performing it known to us

POWER AND DATA COMMUNICATIONS TRANSMISSION SYSTEM

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for transmission of power and data, and more particularly relates to a method and system for simultaneously transmitting power and data communications between a number of modules or terminals remotely located from each other.

BACKGROUND OF THE INVENTION

In British Patent No. 2300849, to Drucegrove Limited, there is disclosed a communications system particularly adapted to elevator systems or other transit systems whereby power and control signals are transmitted over a two wire bus structure from a master controller unit to various local modules. The power is modulated using pulse width modulation by interrupting the power supplied via the bus and is only designed to be used for DC systems. Certain problems exist in this system due to the fact that no energy is delivered to the load modules during periods of data transmission. Instead power during this period is transmitted from filter devices in the remote modules so as to maintain power to the systems during periods of data activity. Use of such filters can lead to a failure of a system due to capacitances that may be placed on the line due to a fault condition and, although power is available for the system, the integrity of the data transmitted can be corrupted and therefore each remote module may not be able to act or function in a particular way as required or expected from the master controller.

Furthermore, if the length of such a two-wire bus is excessive as in lift systems, external noise and line capacitance or line inductance may result in a poor data recovery at the remote modules. The above system is also not adapted for AC supplies but is only useable for DC systems.

The above arrangement together with other existing systems that use DC supply modulation incur switching transients on the line as a result of the modulation. The inherent line reactance may further cause undershoot or overshoot which may affect the integrity of the transmitted data.

The present system seeks to overcome or substantially ameliorate any one or more of the above disadvantages by providing a method and system that is equally

applicable for both AC and DC systems. All of the available energy from the power supply is transmitted to each of the remote modules and at the same time data is also transmitted and received on a two wire bus system. As such this substantially eliminates any noise or reactance on the line and therefore provides data between the various modules that is not corrupted. The present system can operate reliably over many kilometres and is applicable to any system requiring power and data transmission between a number of modules. Thus there is a substantial increase in immunity to induced noise and increased line reactance from equipment used in the system and the data transmitted between such modules maintains its integrity.

SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided a method of controlling one or more remote modules connected to an AC transmission line, wherein an AC signal is supplied via said AC transmission line to each of the remote modules for providing power and data to each remote module, the method comprising the steps of:

transmitting control data from a master controller module to said one or more remote modules for controlling said one or more modules or requesting a response from said one or more remote modules;

transmitting an AC signal to said one or more remote modules;

wherein said control data is transmitted to said one or more remote modules as part of the AC signal in response to a polarity reversal of a portion of any cycle of said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

The method may include the step of indicating the transmission of a bit having a first value in response to a polarity reversal as a result of a zero crossing from a positive half cycle to a negative half cycle of said AC signal and indicating the transmission of a bit having a second value in response to a polarity reversal as a result of a zero crossing from a negative half cycle to a positive half cycle of said AC signal as part of the control data.

The method may further include receiving at a remote module control data from said master controller module intended for said remote module and decoding

the control data for use by said remote module.

The method may also include transmitting response data from any one of said remote modules to said master controller module at the same time as power and or control data is being transmitted to any one or more of said remote modules. Other data may also be transmitted and received between the remote modules simultaneously using existing modulation techniques such as FM, AM or PCM superimposed on the present method or existing with the present method.

According to a second aspect of the invention there is provided a method of transmitting data between a master controller module and one or more remote modules or between one or more remote modules, wherein each of said remote modules and said master controller module are linked by at least one AC transmission line and power in the form of an AC signal is supplied to each of said remote modules, said method comprising the steps of:

transmitting an AC signal along said at least one AC transmission line to said one or more remote modules;

transmitting said data as part of the AC signal wherein the data is transmitted in response to a polarity reversal of a portion of any cycle of any said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

According to a third aspect of the invention there is provided a system for transmitting data comprising:

a master controller module;

one or more remote modules;

AC transmission line means connecting said one or more remote modules to said master controller module;

wherein an AC signal is supplied to said one or more remote modules along said AC transmission line means; and

wherein said data is transmitted between said master controller module and said one or more remote modules as part of the AC signal in response to a polarity

reversal of a portion of any one or more cycles of said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

Each of the remote modules and master controller module may have transceiver means connected to said AC transmission line means for transmission

and reception of said data and the master controller module may have respective transceiver means for transmitting said AC signal.

The system may further comprise means for reversing said polarity of the one or more cycle portions upon detection of one or more zero crossings through a zero crossing detection means.

The polarity reversal from positive half cycles of said AC signal to negative half cycles of said AC signal may indicate transmission of a bit of said data having one value and the polarity reversal from negative half cycles to positive half cycles of said AC signals may indicate transmission of a bit of said data having another value.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will hereinafter be described, by way of example only, with reference to the drawings wherein:

Figure 1 is a block diagram system in accordance with the present invention that uses a two wire transmission line for transmitting power and data between various modules;

Figure 2 is a block diagram of a slightly modified variation of the system as shown in Figure 1 whereby loads are supplied with power externally under the control of remote modules;

Figure 3 is a block diagram of a transmitter portion of a master controller module;

Figure 4 is a block diagram of a receiver portion in each of the master controller module and remote modules;

Figure 5 is a circuit diagram of apparatus used to change the polarity of a supply waveform;

Figure 6a is a waveform of a power supply showing the transmission of information in half cycles of the waveform;

Figure 6b is a waveform of the power supply showing a modified form of the transmission of information within the half cycles of the power supply waveform; and

Figure 7 is a circuit arrangement for providing the supply waveform converted from a direct current supply.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

With reference to Figure 1 there is shown a system 2 configured for transmission of power, in particular from an AC supply, and data over a transmission line in the form of a two wire bus between remote modules and a master controller module or alternatively between any combination of these modules. In particular a master controller module 4 receives power from an AC power supply unit 6 and is connected to conductors 8 and 10 of the two wire bus system 12 through a transceiver 14 at terminals 11 and 13. The transceiver 14 of the master controller module 4 is linked to the terminals 11 and 13 through respective conductors 16 and 18.

Remote modules such as 20 and 22 are also connected to the two wire bus 12 through respective transceiver units. For example remote module 20 has transceiver unit 24 connected to respective terminals 26 and 28 of conductors 8 and 10 of the two wire bus 12. These are linked through conductors 27 and 29 respectively. The master controller module 4, through its power supply 6, delivers AC supply signals over conductors 8 and 10 to each of the remote modules 20, 22 and any other remote modules connected to the two wire bus 12. The master controller module 4 need not necessarily supply power to the entire system, as with reference to Figure 2, an external power supply delivered over conductors 30 and 32 delivers power to loads 34 and 36 which are linked respectively to remote modules 20, 22. The remote modules may control the actual loads under supply derived from the master controller module 4. In this way previously unintelligent loads such as 34 and 36 can be controlled by any or all of the remote modules 20 and 22. It therefore allows a remote module to be added to an electrical and/or mechanical device to control its operation under direction from the master controller module and/or other remote modules units.

On each of the links 37 directed to the master controller module 4 there may be received other data or inputs, for example from a PC or may be data retrieved from other remote modules in the system. Various data may be superimposed.

within the AC supply signal to control the operation of each of the remote modules and to therefore initiate certain actions to be undertaken by each of the remote modules.

Shown in Figure 3 is a transmitter portion 39 forming a part of transceiver 14 in the master control module 4 and optionally as in transceiver 24 in remote module 20. The transmitter portion 39 consists of an input circuit 38 used primarily for any filtering requirements or AC/DC conversion that is necessary for use by the remainder of the transmitter portion. An encoder unit 40 is used to encode any information or instruction required for any one of the remote modules which is serially transmitted in cycles of the AC supply waveform transmitted over the bus 12. The encoder 40 acts under the control of CPU 44 and the output of the encoder is linked to an input of a polarity controller (or phase shift controller) unit 42 arranged to alternate the phase of one or more half cycles of the AC supply waveform upon detection of one or more zero crossings from zero crossing detector 46. The CPU 44 also controls the polarity controller unit 42. When information is ready to be transmitted and at the designated zero crossing detection for a particular half cycle of the AC waveform, the information is output from output circuit 48 on to the conductors 8 and 10 for transmission along the bus to the respective remote module.

With reference to Figure 4 a receiver portion 50 in each of the remote modules is shown with a decoder unit 52 connected to respective terminals 54 and 56 of the bus 12. The decoder unit 52 will analyse any bits of information transmitted within the half cycles of the AC supply waveform and any bits addressed particularly to its remote module will be recorded and analysed and forwarded to CPU 54 for further processing. The CPU 54 then instructs the remote module itself to perform certain tasks in accordance with the decoded information or instruct a load 58, through a driver circuit 56 to perform certain tasks such as the switching on or off of a pump, lights or other circuitry or activate a piece of equipment. Where a reconstruction or reconstitution of the original AC supply signal is required a further polarity controller unit 60 together with a zero crossing detector 62 may be used and placed in between the decoder unit 52 and driver

circuit 56 so that a piece of equipment may operate under the reconstituted AC signal.

Shown in Figure 5 is an example of the implementation of the polarity controller unit and zero crossing detector for changing the phase or polarity of the AC supply signal whereby any one half cycle, either positive or negative, is reversed in polarity. This will then signify the transmission of one bit of information. The polarity controller unit 42 may be configured by a steerable bridge rectifier which is made up of two pairs of diodes with each pair being configured in respective rectifier circuits 64 and 66. Alternatively silicon-controlled rectifiers may be used. AC input supply is fed to respective inputs of each of the rectifier circuits and also to a zero crossing detector unit 46. The rectifier circuit 64 is configured for positive half cycles of the AC supply such as that shown by the shaded region 80 shown in Figure 6a and the rectifier circuit 66 is configured for negative half cycles such as the shaded region 82 shown in Figure 6a. Together under normal flow situations the AC signal would be supplied to a load or a remote module in alternating cycles of positive and negative values. When a bit of information is required to be transmitted on the bus 12 then once a zero crossing, that is where the AC signal changes in value from positive to negative or from negative to positive, is detected by unit 46, a signal will be output from the unit 46 to a (divide by 2) counter or flip flop 68 which will send a signal from its output to the switch structure 70 comprising a pair of double pole double throw synchronous switches 72 and 74. Whichever rectified circuit is controlling the supply it will be reversed in polarity whereby the switch will be moved to its other terminal so that a phase change occurs in the AC waveform without disrupting the supply of power to the remote module. For example if zero crossing 84 is detected a signal is sent to flip flop 68 from the unit 46 to alter the switch 72 as the next positive cycle is 86, identified by the dashed lines in Figure 6a, is controlled by rectifier circuit 64 so that the rectifier circuit 64 has its terminals reversed and effectively a negative value will be transmitted as indicated by the curve portion 88 on the next half cycle. This half cycle will contain one bit of information and the phase change or reversal in polarity occurring after the zero crossing 84 will be detected at the intended remote [illegible] As mentioned previously where a load, for example

module(s) to indicate that a bit of information is received and maybe the first bit in a whole sequence of bits, perhaps forming one or more packets of data to be subsequently received by a particular remote module.

As shown in Figure 6a the standard sinusoidal AC signal characterised by the curve 90 including the dashed portion 86 in one half cycle is shown. As previously described this half cycle has one bit of information superimposed on the AC signal as indicated by the phase alternation or phase reversal of the signal. This does not affect the power supply to the remote module as the full amount of power, as indicated by the area under the curve, is still transmitted to the remote module.

Shown in Figure 6b the particular AC signal waveform is characterised in that after zero crossing 92 a phase reversal has occurred where one bit of information is transmitted during the half cycle indicated by the shaded area 94. Thus normally rectifier circuit 66 would be in operation however its polarity has been reversed to indicate the transmission of the bit. Again after zero crossing 96 normally the wave would be as shown by the dotted line but again a phase reversal has occurred whereby another bit of information has been transmitted as part of the signal in the half cycle 98 whereby the phase terminal reversal has occurred on rectifier circuit 64 under the action of switch 72 in response to the zero crossing detection from unit 46. Thus it can be seen that the bridge rectifier acting as the phase shift or polarity controller 42 is a steerable unit through the reversal of polarity on each of its rectifier circuits 64 and 66. The polarity reversal upon reaching a zero crossing where the AC wave form changes from positive half cycles to negative half cycles in time may indicate the transmission of a bit of one value, such as a "1", and polarity reversal upon reaching a zero crossing whereby the waveform changes from negative half cycles to positive half cycles in time may indicate the transmission of a bit of another value, such as a "0". However it is to be understood that the polarity indication is not limited to this. In other words any bit value may be transmitted in either negative or positive half cycles. The decision as to what polarity the AC waveform is to have is made at or before the relevant zero crossing.

As mentioned previously where a load, for example 58 being driven by

driver circuit 56 is required to perform an operation based on the reconstructed AC signal originally supplied from power supply 6, then the circuit arrangement shown in Figure 5 enables such reconfiguration of the AC signal to appear at the output.

terminals 100 which would be input to the driver circuit 56. The polarity controller unit 60 and zero crossing detector 62 would be implemented in between the decoder 52 and the driver circuit 56 of the receiver unit in the remote module.

Where a direct current is supplied from a power supply unit 102 shown in Figure 7 to circuit elements within a master controlling module, the arrangement 100 allows for the conversion to AC supply through a digital to analogue converter 106. The power supply unit 102 supplies direct current to microprocessor 104 and on the basis of control inputs 110 to the microprocessor 104 the converter 106 converts the direct current to alternating current taking into account the polarity reversal on detection of the relevant zero crossing. This is done through a line 112 which provides such polarity control from the microprocessor 104 to the converter 106. At the output to the converter 106 the AC supply signal is amplified through amplifier or line driver 108 to the correct amplitudes for transmission on to the AC transmission line which delivers the signal to various remote modules. The AC signal includes all the necessary phase reversals indicating control data or other data that is destined for the remote modules. The arrangement 100 therefore allows master controller modules to use DC power and then convert this DC power into AC power having the required polarity excursions to indicate the transmission of control data within the AC signal supplied to the remote modules. Thus the AC supply signal may be provided by an existing AC supply or be synthesised using DC to AC conversion techniques where a DC signal is used.

With regard to the transmitter portion described in Figure 3 the power supply 6 is shown and this is used with the master controller module 4. For remote modules having transmitter portions generally there will be no power supply unless there is a separate power supply activating or powering a load attached to the remote module. Thus information may be transmitted from one remote module through its transmitter portion either to another remote module or back to the master controller module 4 along the bus 12. This is in cases where responses are required from a particular remote module by the master controller module 4. Such responses may include information on the state of a switch, or temperature or humidity

sensors as in an irrigation application or on certain remote devices controlled within or by a remote module. The information is transmitted by the transmitter unit of the remote module in a standard fashion where it is coded by an encoder unit 40 and then output to the output circuit 48 where it is then transmitted or passed over onto the bus 12 under the direction of its CPU.

The above described system is readily adapted for DC systems where remote modules may have full wave rectifiers fitted as part of their transceivers to rectify the AC signal into a DC supply.

The above described system is particularly applicable to apparatus that uses low voltage, such as 24 volts, alternating current supply and which for a standard 50 Hz AC signal will provide a transmission rate of 100 baud or 100 bits per second. It is to be understood that the above system may be modified by persons skilled in the art to be used in higher voltage level systems such as 240 volts AC, and for higher transmission rates.

The particular system described allows transmission of data to be in either asynchronous form or synchronous form and allows other modulation techniques to coexist for transmission over a bus 12.

Such modulation techniques may include phase modulation of an AC supply to each of the remote modules, superposition of a tone on the AC supply during either the active portion or for a period close to and including the zero crossing points. A further technique includes superimposing a series of data tones on the AC supply at a number of given intervals or contiguously. This allows responses from any one or more of the remote modules back to the master controller module or to other remote modules in the system. The responses from the remote modules may include data relating to the current status of the operation of a remote module, a measurement from a device attached to or built into the remote module, or the status of data received on a previous transmission to a particular remote module.

The particular data transmitted may be continuous in nature whereby many packets of data are transmitted in blocks such as in a synchronous transmission or maybe asynchronous in nature and be constituted by the transmission of bits at various times and in various lengths. Such packets or bits may signify one or more

start bits so that a receiver unit of a remote module can synchronise and detect additional bits or subsequently transmitted bits from the source transmitter. Thus, for example, the first instance of polarity reversal may be considered as a start indication and set a reference polarity for decoding further polarity reversals in the remainder of a data frame or packet. Other bits may include a data validity check or redundancy check of one form or another, the stream of bits containing the data itself, tones superimposed at any point on the waveform and any response data from a remote module or other master controller module even while the initial transmission is in progress. One or more stop bits may also be included to signify the end of a data transmission. Thus the transmission line or bus structure 12 is configured for bidirectional transmission between any one or more master control and any one or more remote modules or between remote modules.

There are many and varied applications that the above system may be used in where any remote device requires both power and data to be transmitted and/or received and the number of cables involved within the system is required to be minimal. This system furthermore has application in electrically noisy environments where standard forms of communication prove to be either very unreliable or difficult to implement. Such areas may include the elevator industry where control of indication or annunciation devices is used by the present system over a two wire bus structure, irrigation systems where control of remote valves or devices is required and measurements such as temperature or humidity and moisture is required to be received and analysed by a master control module. There is also application in industrial control where control of the interaction with remote devices in the mining, manufacturing or similar industries is required and furthermore in building automation where interaction with systems within a given building is needed for controlling lighting, security and environmental control systems. The invention also has application in the pyrotechnics industry.

The present invention provides a unique and simple system of delivering power and control information over an AC supplied system between a central controlling and a number of remote modules. It also provides for reverse transmission from the remote modules to the central controlling module with

information relating to the remote modules. It provides stable power and data communications over a two wire bus structure thereby reducing the number of cables involved, alleviates the affect of stray line reactance (capacitance/inductance), on the reliability and integrity of data transmitted. It furthermore reduces the affects of induced external noise on the integrity of the data transmitted and allows power and data to be transmitted over traditionally very difficult or unusable lengths of cable. The power supply is unaffected by the phase reversals of the power supply, which indicate transmission of bits, and the full bandwidth of the supply is transmitted to the various remote modules. An extremely high level of waveform distortion is allowable when using this system due to its stable nature and therefore any spuriously induced signals, that could potentially cause either data loss and/or failure in other systems, are readily accepted and dealt with by the present system simply as a function of its operating principles and capabilities. The energy delivered to a particular load over a given period is unrelated to the polarity of excursions occurring within that period, which indicate the transmission of bits, and the power supply efficiency is unaffected by such transmission or phase alternation. Traditional FM, AM or PCM modulations can co-exist with the method and apparatus according to the present invention.

It will also be appreciated that various modifications and alterations may be made to the preferred embodiments above, without departing from the scope and spirit of the present invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of controlling one or more remote modules connected to an AC transmission line, wherein an AC signal is supplied via said AC transmission line to each of the remote modules for providing power and data to each remote module, the method comprising the steps of:

transmitting control data from a master controller module to said one or more remote modules for controlling said one or more remote modules or requesting a response from said one or more remote modules;

transmitting an AC signal to said one or more remote modules;

wherein said control data is transmitted to said one or more remote modules as part of the AC signal in response to a polarity reversal of a portion of any cycle of said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

2. A method according to claim 1 further comprising the step of indicating the transmission of a bit having a first value in response to said polarity reversal as a result of a zero crossing from a positive half cycle of said AC supply signal to a negative half cycle of said AC signal, said bit being part of said control data.

3. A method according to any one of the previous claims further comprising the step of indicating the transmission of a bit having a second value in response to said polarity reversal as a result of a zero crossing from a negative half cycle of said AC signal to a positive half cycle of said AC signal, said bit being part of said control data.

4. A method according to any one of the previous claims further comprising the step of receiving at said one or more remote modules control data destined for a respective remote module and decoding said control data for use by said respective remote module.

5. A method according to any one of the previous claims further comprising the step of transmitting response data from any of said one or more remote modules to said master controller module.

6. A method according to claim 5 wherein said response data is transmitted via said AC transmission line simultaneously as the control data is transmitted from said master controller module.

7. A method according to any one of the previous claims wherein said control data and/or other data is transmitted between said one or more remote modules.

8. A method according to any one of the previous claims further comprising the step of initially transforming said AC signal from a DC signal.

9. A method of transmitting data between a master controller module and one or more remote modules or between one or more remote modules, wherein each of said remote modules and said master controller module are linked by at least one AC transmission line and power in the form of an AC signal is supplied to each of said remote modules, the method comprising the steps of:

transmitting an AC signal along said at least one AC transmission line to said one or more remote modules;

transmitting said data as part of the AC signal wherein the data is transmitted in response to a polarity reversal of a portion of any cycle of said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

10. A method according to claim 9 further comprising the step of transmitting a bit having a first value in response to said polarity reversal as a result of a zero crossing from a positive half cycle of said AC supply signal to a negative half cycle of said AC signal, said bit forming part of said data.

11. A method according to claim 9 or claim 10 further comprising the step of transmitting a bit having a second value in response to said polarity reversal as a result of a zero crossing from a negative half cycle of said AC signal to a positive half cycle of said AC signal, said bit forming part of said data.

12. A method according to any one of claims 9 to 11 further comprising the step of receiving at said one or more remote modules control data destined for a respective remote module and decoding said control data for use by said respective remote module.

13. A method according to any one of claims 9 to 12 further comprising the step of transmitting response data from any of said one or more remote modules to said master controller module.

14. A method according to claim 13 wherein said response data is transmitted via said AC transmission line simultaneously as the control data is transmitted from said master controller module.

15. A method according to any one of claims 9 to 14 wherein said control data and/or other data is transmitted between said one or more remote modules.

16. A method according to any one of claims 9 to 15 further comprising the step of initially transforming said AC signal from a DC signal.

17. A system for transmitting data comprising:

a master controller module;

one or more remote modules;

AC transmission line means connecting said one or more remote modules to said master controller module;

wherein an AC signal is supplied to said one or more remote modules along said AC transmission line means; and

wherein said data is transmitted between said master controller module and said one or more remote modules as part of the AC signal in response to a polarity reversal of a portion of any one or more cycles of said AC signal, said polarity reversal occurring after a zero crossing of said AC signal.

18. A system according to claim 17 wherein said data is control data transmitted from said master controller module to said one or more remote modules to enable a respective remote module to undertake an operation.

19. A system according to claim 17 or claim 18 wherein a respective remote module transmits response data to said master controller module in response to any received control data.

20. A system according to any one of claims 17 to 19 wherein said data is transmitted between any of said one or more remote modules.

21. A system according to any one of claims 17 to 20 further comprising means for alternating the polarity of a portion of said AC supply signal.

22. A system according to claim 21 further comprising detection means for detecting a value of said AC signal.

23. A system according to claim 22 wherein said detection means is a zero crossing detector for detecting the occurrence of a change from positive half cycles to negative half cycles of said AC signal or from negative half cycles to positive half cycles of said AC signal.

24. A system according to claim 23 wherein on detection of said change, said means for alternating initiates said polarity reversal in said AC signal.

25. A system according to claim 24 wherein a polarity reversal as a result of a zero crossing from positive to negative half cycles of said AC signal indicates the transmission of a bit having a first value.

26. A system according to claim 24 or claim 25 wherein a polarity reversal as a result of a zero crossing from negative to positive half cycles of said AC signal indicates the transmission of a bit having a second value.

27. A system according to any one of claims 17 to 26 wherein each of said one or more remote modules has transceiver means connected to said AC transmission line means for transmitting and receiving data between other remote modules or said master controller module.

28. A system according to any one of claims 17 to 27 wherein said master controller module has transceiver means connected to said AC transmission line means for transmitting and receiving data to and from said one or more remote modules.

29. A system according to any one of claims 17 to 28 wherein said AC signal is supplied from said master controller module.

30. A system according to claim 29 wherein said AC signal is transformed from a DC signal supplied to said master controller module.

31. A method of transmitting data substantially as hereinbefore described with reference to the accompanying drawings.

32. A system of transmitting data substantially as hereinbefore described with reference to the accompanying drawings.

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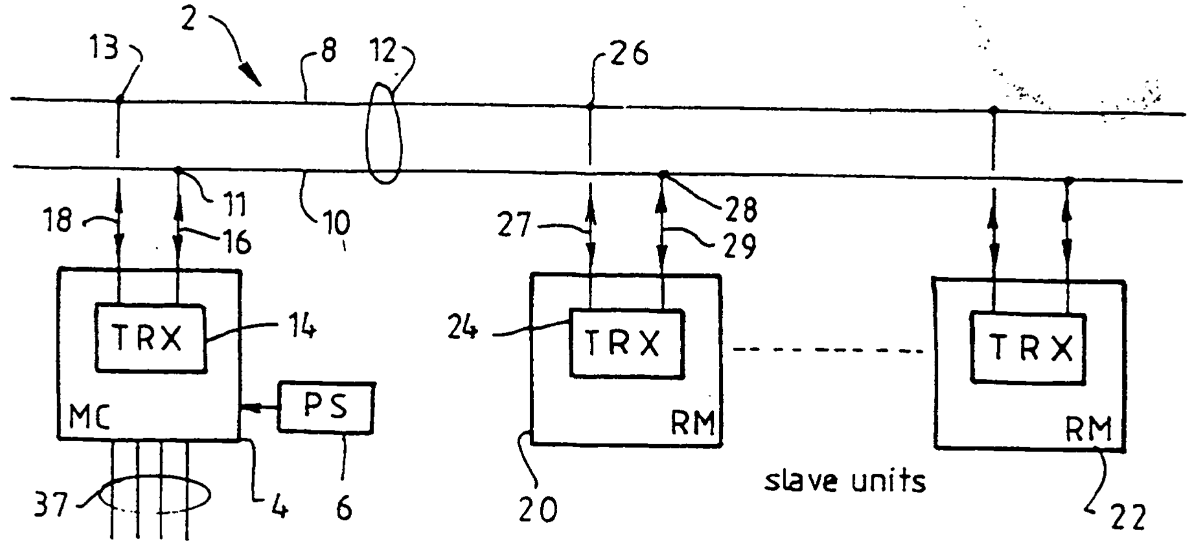
Patent Attorneys for the Applicant:

THE TECHNOLOGY GROUP PTY LTD

ABSTRACT

A method and system for transmitting power and control data between a master controller module (4) and one or more remote modules (20, 22) over an AC transmission line (12). The control data is transmitted as part of an AC signal from the master controller module (4) in response to a polarity reversal of a proportion of any cycle of the AC signal. A polarity reversal can occur on detection of a zero crossing of the AC signal wherein a bit of said control data having a first value is transmitted as a result of a zero crossing from positive to negative half cycles of the AC signal and a bit of said control data having a second value is transmitted as a result of a zero crossing from negative to positive half cycles of the AC signal.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13
8
12
26
11
18
16
10
27
28
29
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TRX
PS
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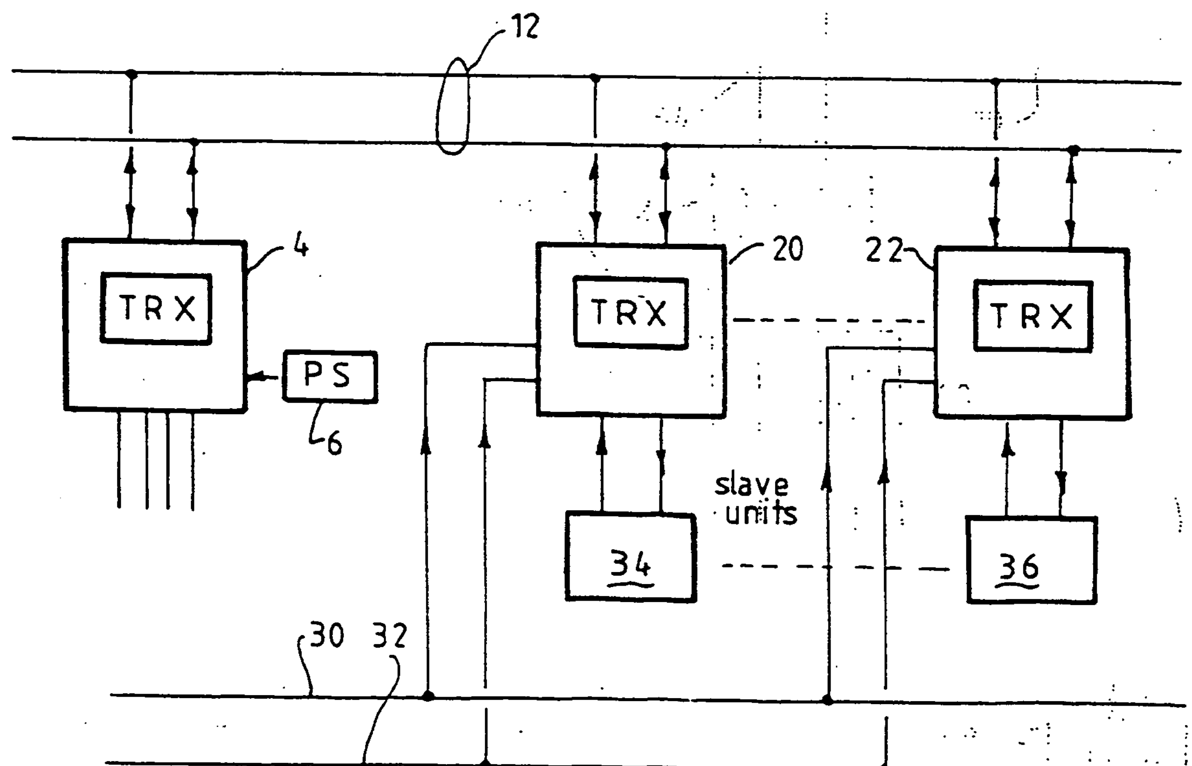
20
slave units
22

FIG. 1.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TRX
20
22
TRX
TRX
PS
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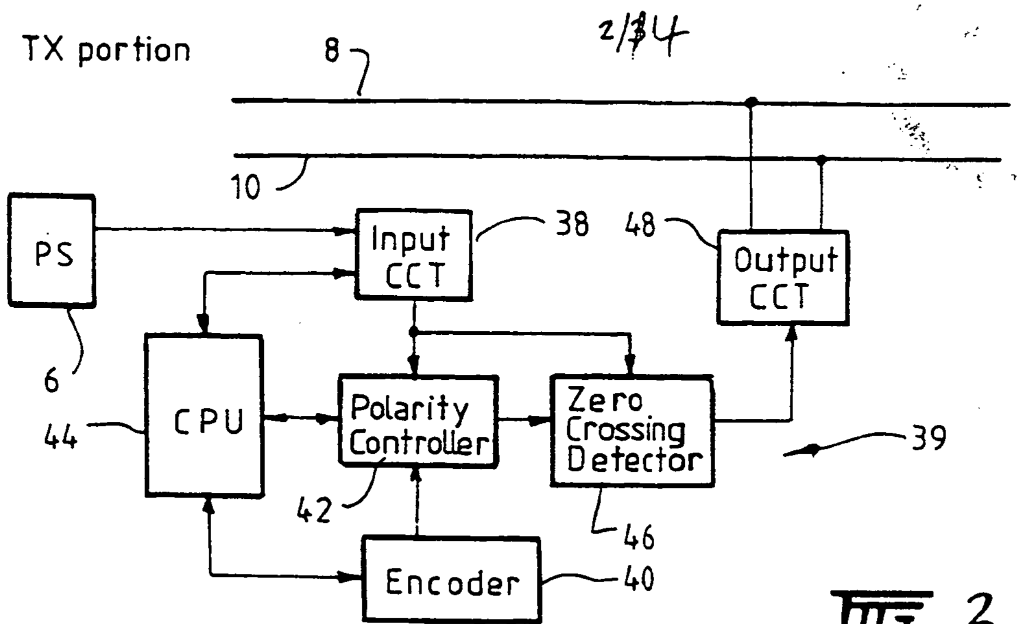
slave units
34
36
30
32

FIG. 2.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10
PS
6
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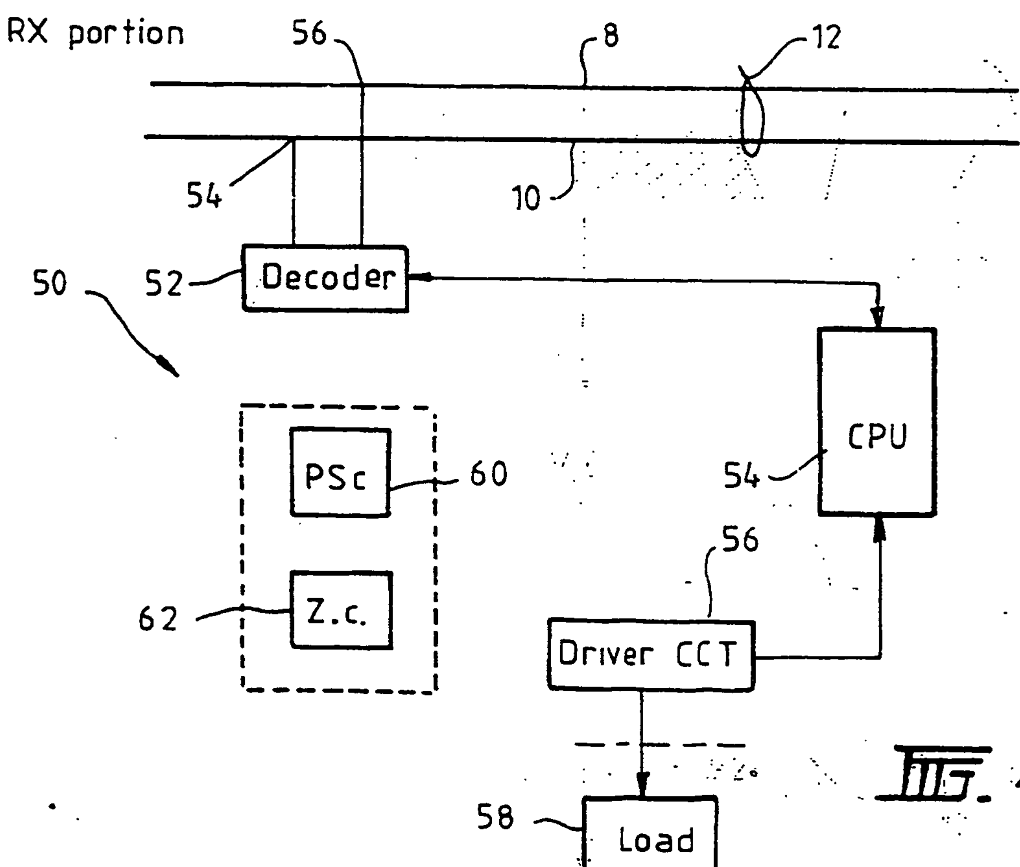
48
Output CCT
CPU
44
Polarity Controller
42
Zero Crossing Detector
46
39
Encoder
40

FIG. 3.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8
12
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10
50
52
Decoder
CPU
PSc
60
54
Z.c.
62
56
Driver CCT
58
Load

FIG. 4.

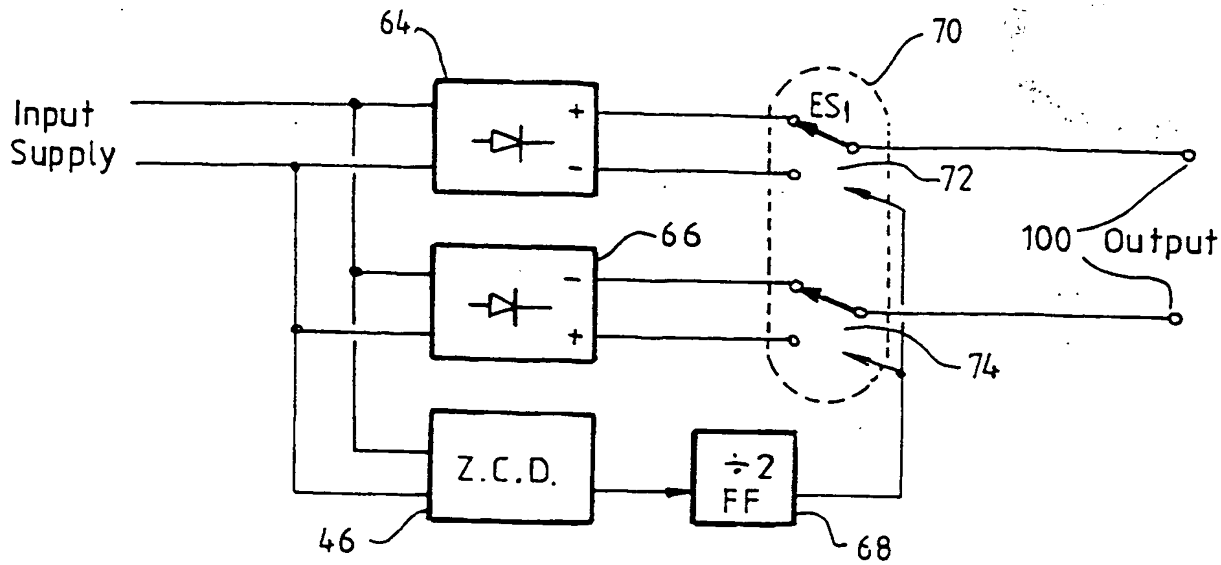

FIG. 5.

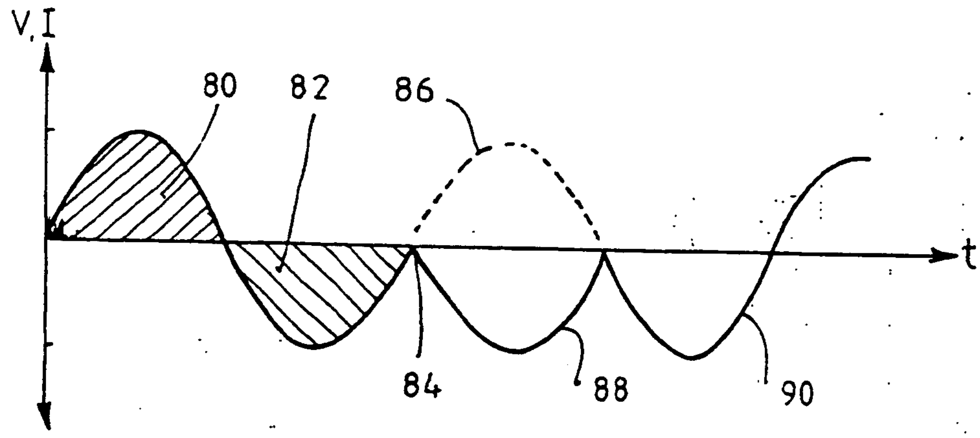

FIG. 6a.

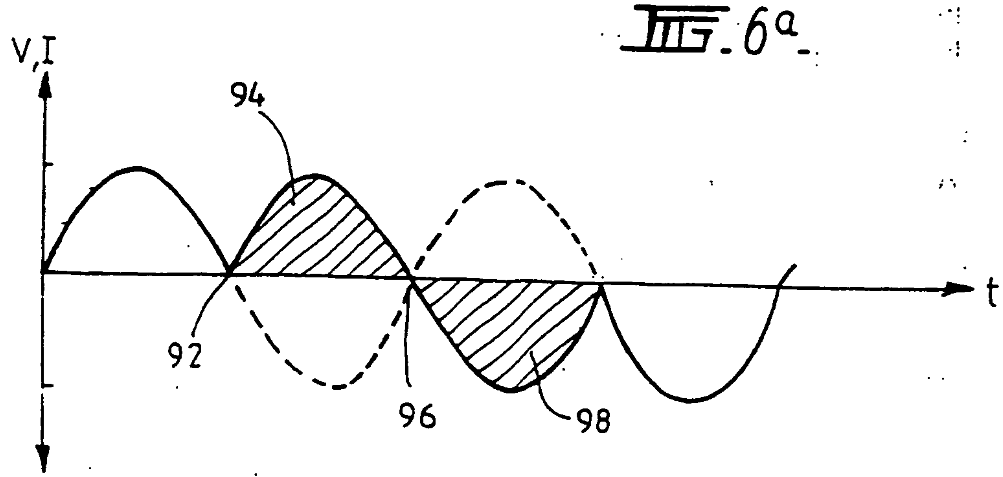

FIG. 6b.

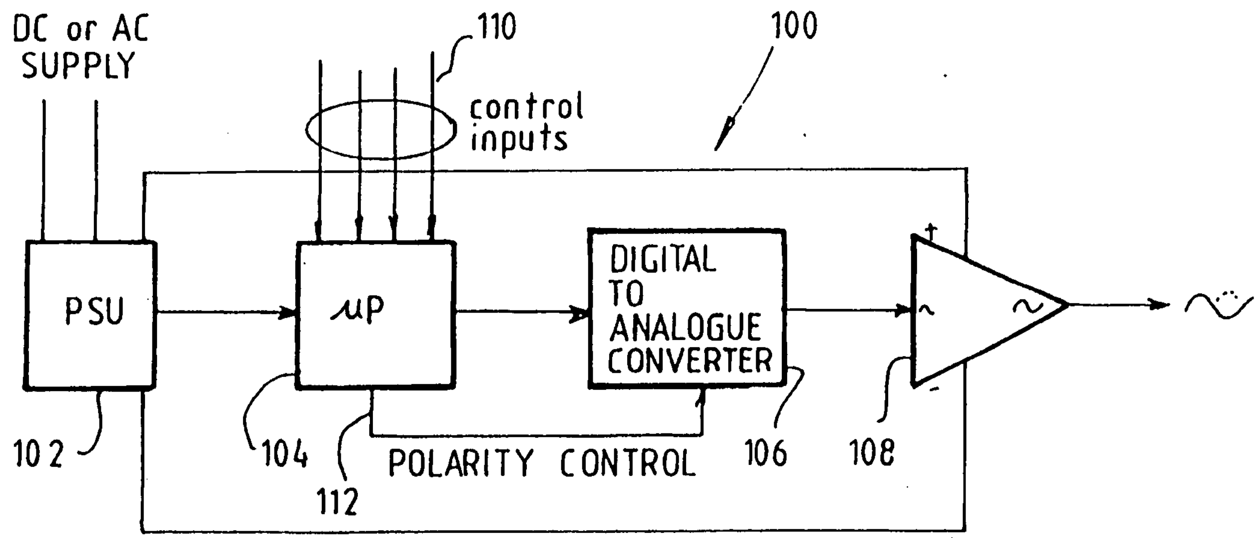
DC or AC SUPPLY
PSU
102
110
control inputs
μP
104
112
POLARITY CONTROL
DIGITAL TO ANALOGUE CONVERTER
106
108
100

FIG. 7.